POST-SCISSION FISSION PHYSICS DATA

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NEED FOR NUCLEAR FISSION DATA

PROMPT FISSION DATA

- before decay of fission products ($\lesssim 10^{-7}$ s)
- neutron multiplicity $\rightarrow$ nuclear-reactor core reactivity
- mean energy release $\rightarrow$ reactor power **(poorly known experimentally as a function of E_n except for ^{238}U)**
- neutron spectrum $\rightarrow$ safeguards and transmutation
- fission-product yields $\rightarrow$ for transmutation issues (long-lived species) and fission theory modeling
- ternary fission fraction $\rightarrow$ He generation in fuel
- **especially for minor actinides**

DELAYED FISSION DATA

- neutron fraction $\rightarrow$ reactor safety
- neutron spectrum $\rightarrow$ safeguards and transmutation

EFFORTS IN FISSION THEORY MODELING

Necessary to analyze experimental data and when data are unavailable.

In collaboration with experimentalists.

POST-SCISSION FISSION PROCESS MODELING

- neutron and γ sequential emission from fission fragments $\Rightarrow$ multiplicity distributions and spectra
- fission-fragment properties: kinetic energy, excitation energy $\Rightarrow$ energy deposition and energy release ; most probable fragmentation ; fragment spins
- **energy partition in fragments still unknown**

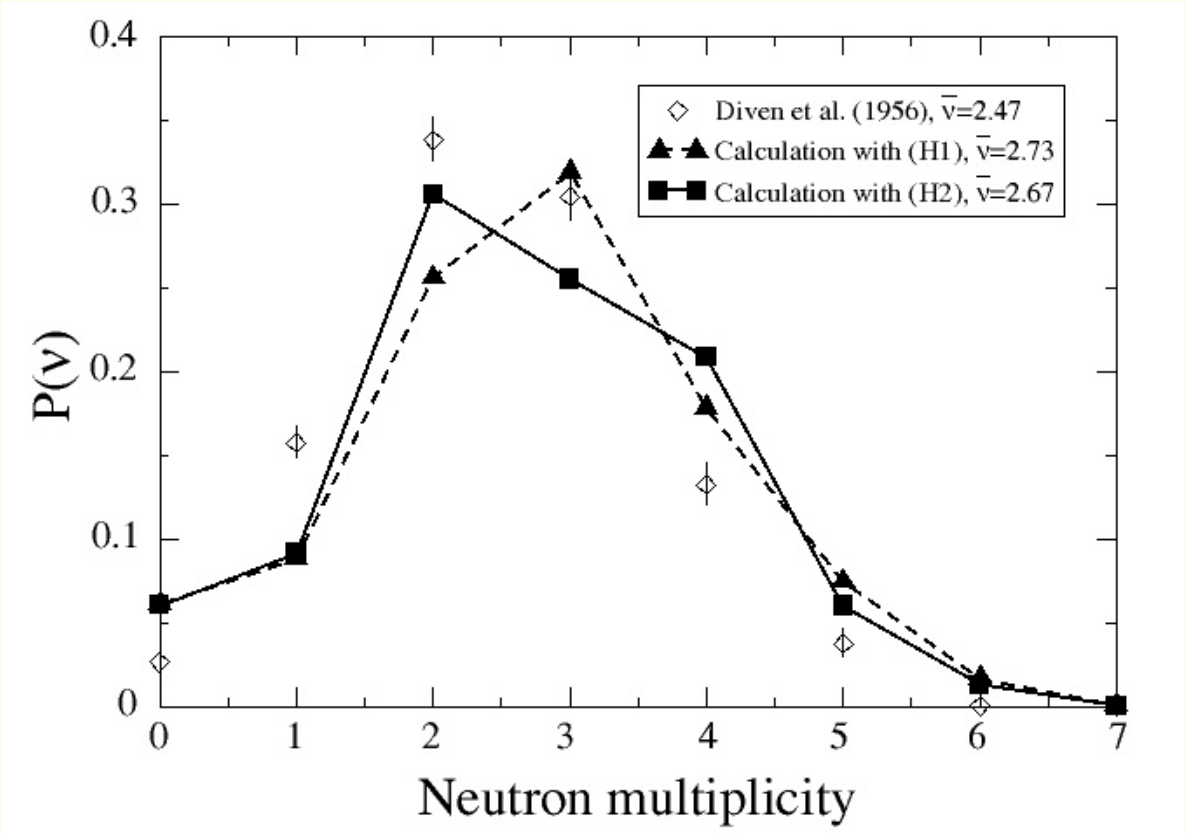
FISSION CROSS SECTIONS MODELING

- multi-humped fission barrier and multi-modal fission $\Rightarrow$ penetrabilities, level densities at saddle points
- width-fluctuation averaging in intermediate structure $\Rightarrow$ reducing factor of fission cross sections

EFFORTS IN FISSION THEORY MODELING

RECENT RESULTS

- Prompt neutron multiplicity distribution for ^{235}U ($E_n = 0.53$ MeV):

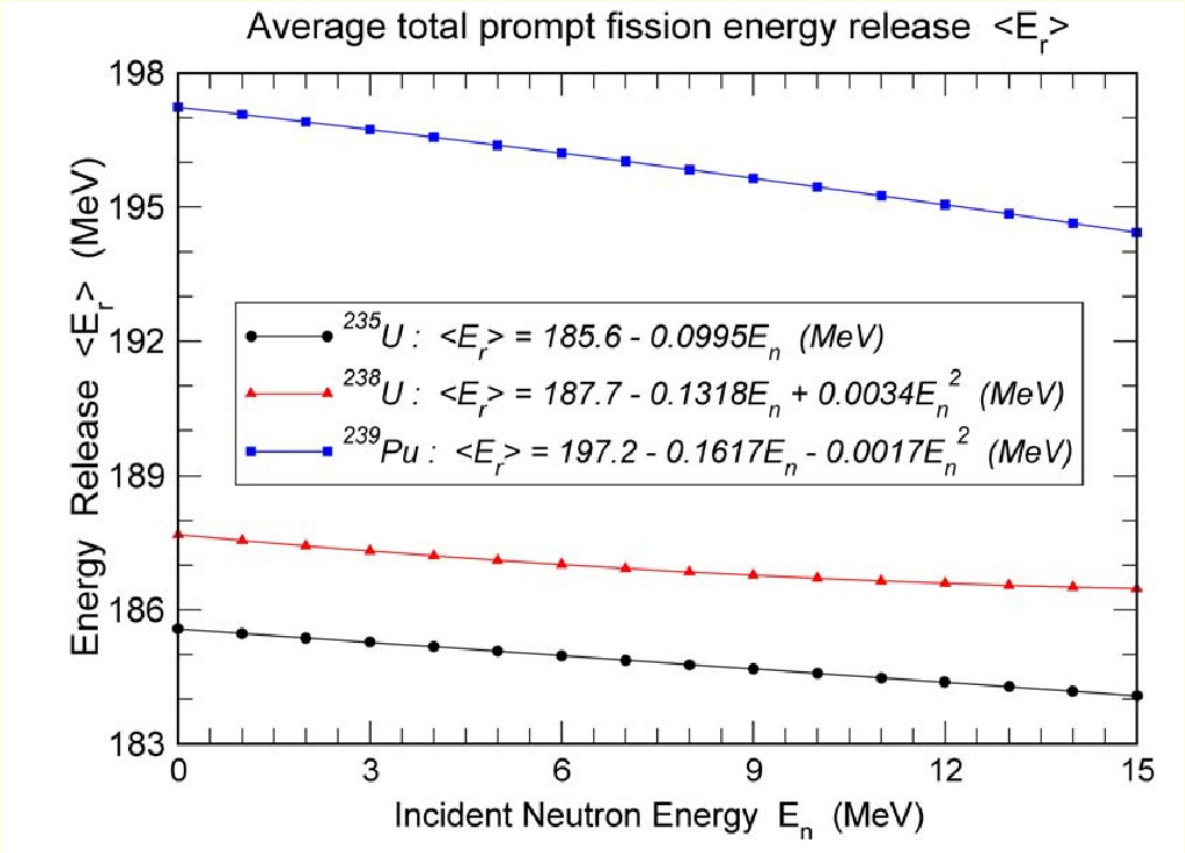


S. Lemaire *et al.*, PRC72 (2005)

EFFORTS IN FISSION THEORY MODELING

RECENT RESULTS

- Prompt fission energy release for ^{235,238}U and ^{239}Pu

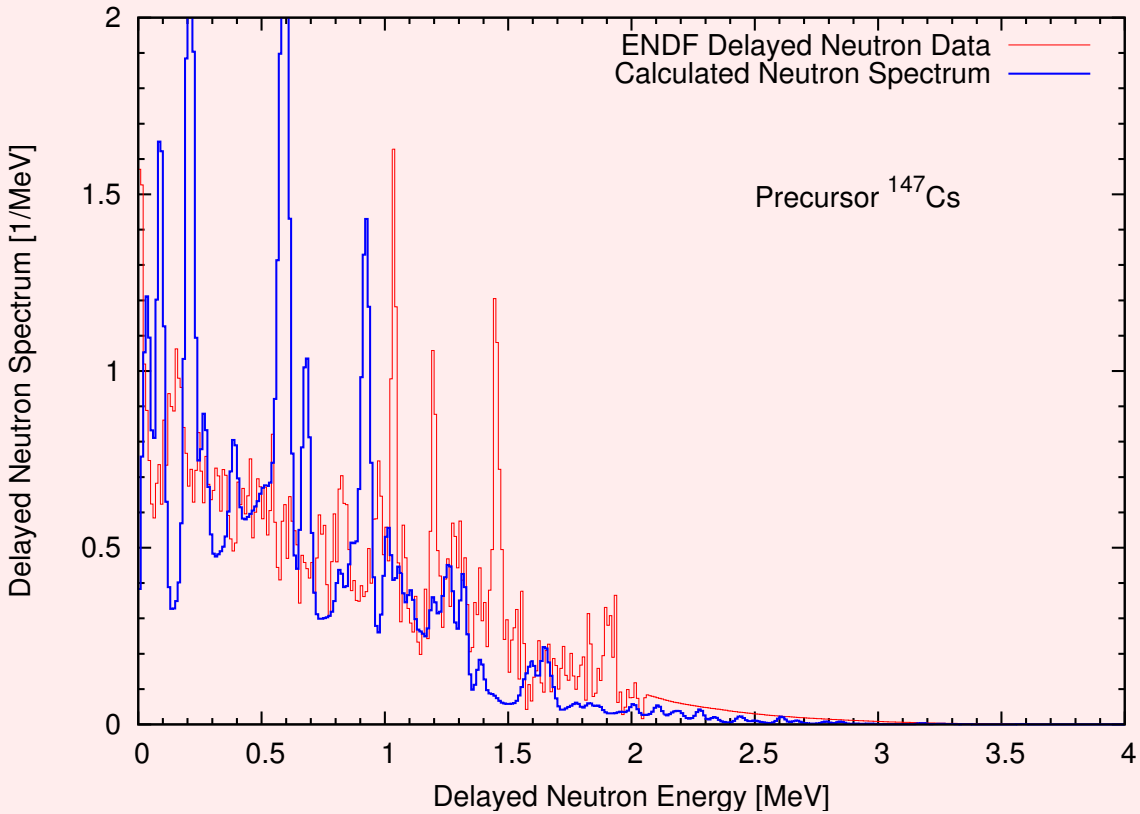


D. Madland, NPA772 (2006)

EFFORTS IN DELAYED NEUTRON EMISSION MODELING

RECENT RESULTS

- Delayed neutron spectrum for precursor ^{147}Cs



T. Kawano, P. Möller and W. B. Wilson, LALP-06-100

HIGH-PERFORMANCE COMPUTING

NEED FOR LARGE COMPUTER POWER

- detailed description of fission decay chain: Monte Carlo calculation of neutron and γ spectra and multiplicity distributions as a function of E_n for a number of actinides
- microscopically grounded fission transmission coefficients: realistic saddle points and fission paths in at least 5D potential-energy surfaces
  Example: Hartree-Fock calculation of the PES of 1 actinide at least 10^5 gridpoints $\times$ 1 CPU hour $\rightsquigarrow$ 10^6 CPU hours
  BUT NON INDEPENDENT GRIDPOINTS
- sensitivity studies for covariance data